Surgical Outcome of Peritoneal Dialysis in Elderly Patients

Xin-Yi Ng[1], Chien-Liang Liu[1,2], Tsang-Pai Liu[1,2], Wen-Ching Ko[1,2], Shih-Ping Cheng[1], Chih-Jen Wu[2,3,4], Jie-Jen Lee[1,5]*

[1]*Department of Surgery, Mackay Memorial Hospital,* [2]*Mackay Medicine, Nursing and Management College,* [3]*Department of Nephrology, Mackay Memorial Hospital,* [4]*Graduate Institute of Medical Sciences, Taipei Medical University, and* [5]*Institute of Pharmacology, Taipei, Taiwan.*

SUMMARY

Background: The success of peritoneal dialysis (PD) in elderly patients has been reported to be either slightly inferior or equivalent to that of younger patients. The purpose of this study was to evaluate the outcome and suitability of PD in older individuals.

Methods: Between January 2005 and December 2007, 67 patients with end-stage renal disease who underwent a surgical PD catheter insertion procedure were enrolled in this study. Complications related to PD catheters, hospital stay, morbidity, mortality, and catheter survival were assessed. Analysis of catheter survival was performed using the Kaplan-Meier method.

Results: Fifteen elderly patients (65 years and older) undergoing PD catheter placement had similar complication rates ($p = 0.568$) and catheter survival (log rank test, $p = 0.805$) to those of the younger group. The postoperative stay was longer in elderly patients (24 vs. 18 days; $p = 0.049$).

Conclusion: Our results indicate that PD is a feasible and safe option for elderly patients with end-stage renal disease. [International Journal of Gerontology 2009; 3(3): 143–148]

Key Words: geriatrics, renal replacement therapy, uremia

The data of this study have been presented in part at the International Conference of Geriatric Emergency and Critical Care in Taipei, Taiwan (December 2008).

Introduction

Age is a key predictor of chronic kidney disease[1], and chronic kidney disease is predominantly a disease of older people[2,3]. In a systematic review, the prevalence of chronic kidney disease in persons aged 64 years or older varied from 23.4% to 35.8%[4]. Advanced renal failure with no reversible cause necessitates renal replacement therapy or renal transplantation. Currently, there is no consensus concerning the optimal mode of renal replacement therapy in elderly patients with end-stage renal disease (ESRD).

Peritoneal dialysis (PD) is often underemployed in older patients, because there is a perception that they may not be able to perform their own dialysis, and social isolation may occur with PD as opposed to hemodialysis[3]. In elderly patients, there is an increased dependence on a partner to perform PD[5]. However, when provided with adequate assistance, PD can be a safe and suitable treatment modality for ESRD even in very old patients[6]. Importantly, older people are more likely to suffer hypotension and silent ischemia during hemodialysis[7]. PD is free of vascular access and provides more stable hemodynamics than hemodialysis[8].

Epidemiologic studies comparing mortality among ESRD patients receiving hemodialysis versus PD have shown conflicting results[9]. It has been reported that

Correspondence to: Dr Jie-Jen Lee, Department of Surgery, Mackay Memorial Hospital 92, Section 2, Chung-Shan North Road, Taipei 10449, Taiwan.
E-mail: jjlee@ms2.mmh.org.tw
Accepted: June 23, 2009

survival of the elderly is better on PD than on hemodialysis[10,11]. In contrast, some studies found that neither hemodialysis nor PD is a superior modality for older patients[12,13], while others have demonstrated that long-term use of PD among elderly patients is associated with increased mortality rates[9,14]. In Taiwan, regardless of diabetes status, patients older than 55 years on hemodialysis experienced better survival than did those on PD[15], although this observation was not confirmed by others[16]. In this respect, it would be interesting to investigate the surgical outcome of PD in older patients. The aim of this study was to analyze the postoperative course of two different age cohorts undergoing PD catheter placement to evaluate differences in complications and technique survival rates.

Materials and Methods

A retrospective review of our patient cohort between January 1, 2005 and December 31, 2007 was performed. During the period, 110 adult patients with ESRD (stage 5 chronic kidney disease) underwent PD catheter placement at our institution. Of these, 43 patients were excluded from the study because of incomplete follow-up. Patients were stratified into two groups according to age. Group A included patients younger than 65 years, whereas Group B included patients 65 years of age or older.

Surgical insertion of a straight two-cuff Tenckhoff catheter was performed by dedicated dialysis access surgeons in an inpatient setting. All procedures were performed under general anesthesia. Briefly, a 4- to 5-cm paramedian incision was made and carried through the subcutaneous tissue, fascia, and muscle layers. The peritoneum was entered, and partial omentectomy was performed in selected patients depending on the surgeons' preference. The catheter tip was fixed in the true pelvis by a silk suture. The distal cuff was placed between the posterior rectus sheath and rectus fibers. The proximal cuff was placed in the subcutaneous tissue about 2.5 cm distal to the exit site. The wound was then closed layer by layer. An abdominal X-ray film was taken routinely to confirm the position of the catheter. There were no significant intraoperative complications and no deaths directly attributable to catheter insertion. Postoperatively, Tenckhoff catheter care was undertaken by trained PD registered nurses according to standard protocols.

New hospitalizations for catheter-related issues were documented during follow-up. All infections related to PD, including exit site infections, tunnel infections and peritonitis, were documented. Peritonitis was diagnosed by cloudy dialysis effluent with a positive Gram stain result or culture from the dialysate. Leakage was defined as any form of leakage located at the exit site or incision. Bleeding was characterized by grossly bloody effluent during dialysis. Malfunction indicated poor dialysis performance excluding all signs of mechanical problems such as blockage, kinking, or displacement of the catheter. Catheter displacement was defined by migration out of the pelvic cavity documented by radiographic findings.

Analysis was performed with the SPSS version 11.5 (SPSS, Chicago, IL, USA). Comparisons between groups were performed using Fisher's exact test or the Student's *t* test as appropriate. Kaplan-Meier survival curves were used to evaluate catheter survival. Patients were followed up until the event of interest occurred, and were censored at the time of transplantation, death or last known follow-up. Plus-minus values were means ± standard deviation. A p value less than 0.05 was considered statistically significant.

Results

A total of 52 patients aged < 65 years (Group A) and 15 patients aged ≥ 65 years (Group B) who underwent PD catheter insertion were included in the study. Patient demographics and baseline characteristics are shown in Table 1. There were 28 men (42%) and 39 women (58%), with a mean age of 53 years (range, 22–87 years). There was no statistically significant difference in the causes of renal failure or comorbidities between the two groups. The mean body mass index (BMI) was 23.2 kg/m^2. Five obese patients (7%) had a BMI greater than 30 kg/m^2. Most patients (76%) were undergoing transient hemodialysis before PD to relieve uremic symptoms and/or complications. Forty patients had double-lumen, silicone rubber catheters for hemodialysis. Hickman catheters were used in seven patients and arteriovenous hemodialysis fistulas in four patients.

Concomitant omentectomy was performed in 14 patients (21% of total). Two patients underwent ventral hernia repair during the catheter placement. There was no postoperative complication necessitating immediate re-operation. Lengths of hospitalization after catheter placement were 18 ± 10 days in Group A and 24 ± 10

Table 1. *Demographics and clinical characteristics of the study population**

	Group A (age < 65 years; $n = 52$)	Group B (age ≥ 65 years; $n = 15$)	p
Females gender	32 (62)	7 (47)	0.378
Body mass index (kg/m^2)	23.0 ± 3.9	23.8 ± 4.1	0.488
Diabetes mellitus	16 (31)	4 (27)	1.000
Prior hemodialysis	38 (73)	13 (87)	0.492
Prior abdominal surgery	5 (10)	3 (20)	0.365
Concomitant omentectomy	11 (21)	3 (20)	1.000
Postoperative stay (d)	18 ± 10	24 ± 10	0.049

**Data are presented as n (%) or mean ± standard deviation.*

Table 2. *Complications in 67 patients undergoing peritoneal dialysis catheter insertion**

	Group A (age < 65 years; $n = 52$)	Group B (age ≥ 65 years; $n = 15$)	p
Any complications	20 (38)	7 (47)	0.568
Peritonitis	12 (23)	4 (27)	0.743
Leak	1 (2)	1 (7)	0.400
Hernia	3 (6)	1 (7)	1.000
Bleeding	2 (4)	0 (0)	1.000
Malfunction	4 (8)	1 (7)	1.000
Occlusion	2 (4)	0 (0)	1.000
Kinking	1 (2)	0 (0)	1.000
Displacement	1 (2)	0 (0)	1.000
Hydrothorax	1 (2)	1 (7)	0.400
Catheter failure	10 (19)	3 (20)	1.000
Follow-up (mo)	19.0 ± 10.4	16.7 ± 7.9	0.378

**Data are presented as n (%) or mean ± standard deviation.*

days in Group B ($p = 0.049$). The difference was marginally statistically significant.

During follow-up, 27 patients (40%) developed one or more episodes of predetermined complications (Table 2). The complication rates were comparable between the two groups. The most common complication was peritonitis, which occurred in 16 patients (24%). Among these, nine patients (56%) had catheters removed and were switched to hemodialysis. Causative peritonitis pathogens included *Escherichia coli* ($n = 2$), *Enterobacter* ($n = 1$), methicillin-resistant *Staphylococcus* ($n = 1$), *Acinetobacter baumannii* ($n = 1$), and *Mycobacterium tuberculosis* ($n = 1$). Four patients developed incisional hernia during the observation period. An additional two patients had subsequent inguinal hernia which was not detected preoperatively. One patient had failed umbilical hernia repair done at the same time as the catheter placement.

Overall, 13 patients (19%) experienced catheter loss and were transferred to hemodialysis a mean of 12 months after catheter placement. Causes of technique failure in our cohort included peritonitis ($n = 9$), malfunction (dialysis inadequacy, $n = 1$), kinking ($n = 1$), pleuroperitoneal fistula ($n = 1$) and cecal tumor rupture ($n = 1$). Mechanical complications were relatively infrequent during our review periods. There was no significant difference in catheter survival between the two groups (log-rank test, $p = 0.805$; Figure).

There were seven deaths during follow-up. Four patients died of unrelated causes with functioning catheters. One patient succumbed to rupture of a cecal tumor, which was not detected during PD catheter placement. One patient died of disseminated tuberculosis and one patient had fatal peritonitis at postoperative months 12 and 26, respectively.

Discussion

This study demonstrated that postoperative complications and catheter survival were not different between

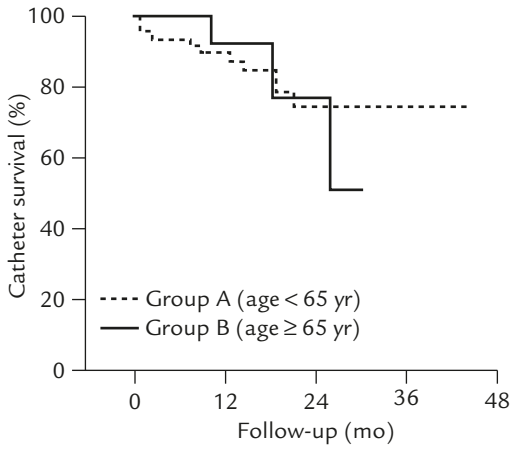

Figure. Catheter survival for patients following peritoneal dialysis catheter insertion. Curves were plotted based on the Kaplan-Meier method. No significant difference was seen by the log-rank test ($p = 0.805$).

elderly patients and younger counterparts. However, older patients may require a longer postoperative hospital stay to acquire familiarity with optimal catheter care.

The prevalence of chronic kidney disease among the elderly is high. For those without hypertension and diabetes, stages 3 to 5 chronic kidney disease is infrequent in young adults (prevalence of 0.2% in the age group 20 to 39 years) but relatively common among older individuals (prevalence of 16% in the age group ≥ 70 years)[1]. Aging changes in the kidney include decreased number of glomeruli, decreased number and size of tubules, and in most individuals, a progressive decrease in glomerular filtration rate[3,17,18]. For elderly patients with ESRD, the likelihood of receiving kidney transplantation is significantly lower than for younger adults[19]. In these patients, renal replacement therapy becomes necessary to maintain homeostasis.

PD is an effective modality of renal replacement therapy for elderly patients[2,8]. In Taiwan, the percentage of ESRD patients on PD is approximately 7%[16]. It has been suggested that lack of confidence and/or understanding of the PD modality by patients and clinicians is the probable cause of the low prevalence rate of PD in Taiwan. According to the North Thames Dialysis Study, clinical outcomes and quality of life are similar in elderly people on PD and on hemodialysis[20]. Compared with hemodialysis, PD is associated with more stable hemodynamics, less risk of hypotension, no necessity for vascular access, less expense, ease of travel, avoidance of the need for transport, and maintenance of residual renal function[8,21]. Theoretically, PD offers some advantages for elderly patients, especially for those with severe cardiovascular disease and difficult vascular access.

Although the use of PD has increased dramatically over the past years after recognition of the benefits, the demonstration that PD can provide long-term dialysis is limited to a small number of patients[22]. Only 0.4–4.8% of the patients continue on PD beyond 8 years[23]. The high dropout rate in PD is one of the reasons for the low utilization of PD and is a limiting factor in establishing long-term PD[24]. Patient survival is one of the factors determining dropout. As aforementioned, results of the studies comparing mortality among patients on hemodialysis versus PD are quite variable. It is difficult to compare studies, because they differ in patient characteristics, in dialysis methods, and in experience of healthcare personnel. Technique survival is, therefore, a surrogate end point to evaluate surgical outcome. In our study, catheter survival was similar between younger and older persons. This is in keeping with the experience of others[16,25–27].

Peritonitis and exit site infection are the most common complications of PD and are also the leading cause of technique failure[2,23]. Older patients may suffer from comorbid conditions associated with normal aging such as impaired vision and decreased physical and mental activity, poor mobility, and cognitive problems, which may impair self performance of the dialysis procedure and may cause infection to the catheter because of poor handling and contamination[2]. In our study, the peritonitis rate was slightly higher in the elderly group than in the younger group without significant difference (27% vs. 23%; $p = 0.743$). Some authors found a higher peritonitis rate in elderly patients[5], but most studies showed a similar peritonitis rate[26–28]. Surprisingly, exit site and tunnel infections have been found to be less common in older patients[26], probably because older patients are less active than younger counterparts[2].

Patients receiving PD have increased intraperitoneal pressure owing to the presence of fill volume in the peritoneal cavity. Hernia is another common complication of PD. The reported prevalence of hernia in PD patients is approximately 11–12% in most series[29–31]. Umbilical hernia is the most frequent type of hernia encountered[29,32]. The incidence of hernia seems unrelated to exchange volumes[30,31]. Low body weight is one of the risk factors[29], suggesting that malnutrition, frequently seen in old patients[2,6], may play a role in the pathophysiology of hernia development. Notably, Garcia-Urena et al.[32] showed that most hernias in PD patients

occurred before starting dialysis. The low incidence of hernia development in our study is probably the result of a relatively short follow-up and the possibility that some asymptomatic hernias may have been missed. It is worth pointing out that the paramedian technique we adopt to insert PD catheters may reduce hernia occurrence[33].

The length of stay is a useful tool to detect immediate postoperative complications[34,35]. Postoperatively, elderly patients are prone to hypothermia, fluid and electrolyte imbalance, and postoperative delirium; therefore, recovery from a surgical procedure may be longer in the elderly[36]. In this study, the duration of hospitalization after catheter placement was longer in older patients, with no increase in complication rates. Previous studies showed that cardiovascular impairment, as expected, was more frequent in older than in younger patients[7]. Differences in hospital stays can be attributed to hospitalization for vascular disease[28]. An alternative explanation is that it may take a longer time to complete training and continuing education for a successful PD program in elderly patients.

In conclusion, we confirm previous observations that PD is an appropriate treatment modality for elderly ESRD patients. There is no difference in PD-related complications and technical failure rate between geriatric and young patients.

References

1. Coresh J, Astor BC, Greene T, et al. Prevalence of chronic kidney disease and decreased kidney function in the adult US population: Third National Health and Nutrition Examination Survey. Am J Kidney Dis 2003; 41: 1–12.
2. Dimkovic N, Oreopoulos DG. Chronic peritoneal dialysis in the elderly: a review. Perit Dial Int 2000; 20: 276–83.
3. Lamb EJ, O'Riordan SE, Delaney MP. Kidney function in older people: pathology, assessment and management. Clin Chim Acta 2003; 334: 25–40.
4. Zhang QL, Rothenbacher D. Prevalence of chronic kidney disease in population-based studies: systematic review. BMC Public Health 2008; 8: 117.
5. De Vecchi AF, Maccario M, Braga M, et al. Peritoneal dialysis in nondiabetic patients older than 70 years: comparison with patients aged 40 to 60 years. Am J Kidney Dis 1998; 31: 479–90.
6. Dimkovic NB, Prakash S, Roscoe J, et al. Chronic peritoneal dialysis in octogenarians. Nephrol Dial Transplant 2001; 16: 2034–40.
7. Capuano A, Sepe V, Cianfrone P, et al. Cardiovascular impairment, dialysis strategy and tolerance in elderly and young patients on maintenance haemodialysis. Nephrol Dial Transplant 1990; 5: 1023–30.
8. Brown EA. Peritoneal dialysis versus hemodialysis in the elderly. Perit Dial Int 1999; 19: 311–2.
9. Vonesh EF, Snyder JJ, Foley RN, et al. Mortality studies comparing peritoneal dialysis and hemodialysis: what do they tell us? Kidney Int 2006; 70 (Suppl 103): S3–11.
10. Maiorca R, Vonesh E, Cancarini GC, et al. A six-year comparison of patient and technique survivals in CAPD and HD. Kidney Int 1988; 34: 518–24.
11. Heaf JG, Lokkegaard H, Madsen M. Initial survival advantage of peritoneal dialysis relative to haemodialysis. Nephrol Dial Transplant 2002; 17: 112–7.
12. Gentil MA, Carriazo A, Pavon MI, et al. Comparison of survival in continuous ambulatory peritoneal dialysis and hospital haemodialysis: a multicentric study. Nephrol Dial Transplant 1991; 6: 444–51.
13. Lunde NM, Port FK, Wolfe RA, et al. Comparison of mortality risk by choice of CAPD versus hemodialysis among elderly patients. Adv Perit Dial 1991; 7: 68–72.
14. Termorshuizen F, Korevaar JC, Dekker FW, et al. Hemodialysis and peritoneal dialysis: comparison of adjusted mortality rates according to the duration of dialysis: analysis of The Netherlands Cooperative Study on the Adequacy of Dialysis 2. J Am Soc Nephrol 2003; 14: 2851–60.
15. Huang CC, Cheng KF, Wu HD. Survival analysis: comparing peritoneal dialysis and hemodialysis in Taiwan. Perit Dial Int 2008; 28 (Suppl 3): S15–20.
16. Hung CC, Chang CT, Lee CC, et al. Prognostic predictors of technique and patient survival in elderly Southeast Asian patients undergoing continuous ambulatory peritoneal dialysis. Int J Clin Pract 2009; 63: 254–60.
17. Lindeman RD. Overview: renal physiology and pathophysiology of aging. Am J Kidney Dis 1990; 16: 275–82.
18. Martin JE, Sheaff MT. Renal ageing. J Pathol 2007; 211: 198–205.
19. Sun CY, Lee CC, Chang CT, et al. Commercial cadaveric renal transplant: an ethical rather than medical issue. Clin Transplant 2006; 20: 340–5.
20. Lamping DL, Constantinovici N, Roderick P, et al. Clinical outcomes, quality of life, and costs in the North Thames Dialysis Study of elderly people on dialysis: a prospective cohort study. Lancet 2000; 356: 1543–50.
21. Neil N, Walker DR, Sesso R, et al. Gaining efficiencies: resources and demand for dialysis around the globe. Value Health 2009; 12: 73–9.
22. Gokal R. Long term peritoneal dialysis—is it a reality? J Nephrol 1999; 12: 362–70.

23. Thodis E, Passadakis P, Lyrantzopooulos N, et al. Peritoneal catheters and related infections. Int Urol Nephrol 2005; 37: 379–93.
24. Giannattasio M, Buemi M, Caputo F, et al. Can peritoneal dialysis be used as a long term therapy for end stage renal disease? Int Urol Nephrol 2003; 35: 569–77.
25. Yang X, Fang W, Kothari J, et al. Clinical outcomes of elderly patients undergoing chronic peritoneal dialysis: experiences from one center and a review of the literature. Int Urol Nephrol 2007; 39: 1295–302.
26. Holley JL, Bernardini J, Perlmutter JA, et al. A comparison of infection rates among older and younger patients on continuous peritoneal dialysis. Perit Dial Int 1994; 14: 66–9.
27. Baek MY, Kwon TH, Kim YL, et al. CAPD, an acceptable form of therapy in elderly ESRD patients: a comparative study. Adv Perit Dial 1997; 13: 158–61.
28. Nissenson AR, Diaz-Buxo JA, Adcock A, et al. Peritoneal dialysis in the geriatric patient. Am J Kidney Dis 1990; 16: 335–8.
29. Afthentopoulos IE, Panduranga Rao S, Mathews R, et al. Hernia development in CAPD patients and the effect of 2.5 l dialysate volume in selected patients. Clin Nephrol 1998; 49: 251–7.
30. Bleyer AJ, Casey MJ, Russell GB, et al. Peritoneal dialysate fill-volumes and hernia development in a cohort of peritoneal dialysis patients. Adv Perit Dial 1998; 14: 102–4.
31. Hussain SI, Bernardini J, Piraino B. The risk of hernia with large exchange volumes. Adv Perit Dial 1998; 14: 105–7.
32. Garcia-Urena MA, Rodriguez CR, Vega Ruiz V, et al. Prevalence and management of hernias in peritoneal dialysis patients. Perit Dial Int 2006; 26: 198–202.
33. Spence PA, Mathews RE, Khanna R, et al. Improved results with a paramedian technique for the insertion of peritoneal dialysis catheters. Surg Gynecol Obstet 1985; 161: 585–7.
34. Cheng SP, Chang YC, Liu CL, et al. Factors associated with prolonged stay after laparoscopic cholecystectomy in elderly patients. Surg Endosc 2008; 22: 1283–9.
35. Cheng SP, Liu CL, Chen HH, et al. Prolonged hospital stay after parathyroidectomy for secondary hyperparathyroidism. World J Surg 2009; 33: 72–9.
36. Cheng SP, Yang TL, Jeng KS, et al. Perioperative care of the elderly. Int J Gerontol 2007; 1: 89–97.